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Hawaii Agricultural Experiment Station

HONOLULU

E. V. WILCOX, Special Agent in Charge

PRESS BULLETIN No. 46.

POULTRY MANAGEMENT

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Agronomist.

Introduction.

The first bulletin issued by this Station was upon the subject of "Chickens and Their Diseases in Hawaii." Attention was called therein to some of the diseases prevalent in Hawaii, and to the inadequate supply of Hawaiian live and dressed poultry and eggs upon the local market. Since then there has been a notable increase in the population and the amount of poultry products imported. The imports during the year ending June 30, 1911, amounted to about $65,000, and for the following year about $85,000.

While there are difficulties in raising poultry in the tropics, these are not insurmountable, and with the proper attention to the details of the business, there is no reason why there should not be under present prices a good profit obtained. Besides supplying the usual demand there are other outlets for such products in filling army contracts and in supplying the boats which touch at Hawaiian ports. The establishment of a Territorial Marketing Division, and the formation of cooperative societies and poultry associations among farmers, have lent an impetus to this industry and created a demand for more general information upon the subject.

Local Conditions and Markets.

The more prevalent diseases of chickens in Hawaii are: Sorehead, colds, catarrh and roup; and the troubles due to such parasites as lice, mites, fleas, intestinal and eye worms. The almost continuous wind in many locations with faulty construction of buildings results in drafts in poultry houses and to this cause all of the colds and much of the roup may be traced. The parasites may be held in check if fought intelligently and most of the other diseases may be prevented with careful management and the observance of sanitary precautions. The mongoose, upon all of the islands but Kauai, is a pest against which eggs and young chicks must be protected, but with proper fencing and the use of dogs and traps, no loss from this source need be met. The only other drawback to the industry is the difficulty of growing feed for poultry and this can in part be obviated. Even if all feed must be purchased, there should still be considerable profit. Corn can be grown nearly everywhere at certain seasons, sorghums only where birds will not molest, but alfalfa, lettuce and other green feed may be produced everywhere.

Careful management of poultry is more necessary for success than with many other classes of live stock. Lack of good management in this business quickly and certainly results in loss. Infertility of eggs results from poor management of the breeding stock. Loss in incubation and in raising young chicks soon follows any mismanagement. A low egg production is sure to follow any fault in the feeding. To succeed with poultry, therefore, one must give them care and thoughtful attention and not leave them to manage and feed themselves.

With the best of management and care, too much must not be expected of poultry. Do not figure profits in advance. Bear in mind that the average figures run about as follows: In the spring months only about 90 per cent of the eggs will be fertile, at other times, less; 75 per cent may hatch strong chicks and perhaps 80 per cent of these will live to a productive age. Such things as these must be remembered in estimating the cost of production.

Withdrawn

The high cost of feed and of transportation from outlying districts, the high price of land accessible to market, and of building materials are factors also that greatly affect cost of production. However, the mildness of the climate makes elaborate buildings unnecessary, prevention of diseases is for the most part possible by proper care and attention to cleanliness, good prices have always been obtained for poultry products, and there is at present almost a clear field offered to those engaging in the business. But few can make a success of the poultry business by itself and the raising of such products has been and always will be carried on as a side-line by those engaged in the production of other commodities.

The following wholesale prices prevail upon the Honolulu market, the higher prices being obtained during the late fall and holiday season:

Roosters	30 to 35 cts. per lb. live weight
Hens	25 to 30
Roasters (10-12 mos.)	35
Broilers (5-6 mos.)	35 to 40
Muscovy ducks	30 to 35
Hawaiian ducks	$5 to $6 per dozen at 4 or 5 mos. (65 cts. each retail)
Turkeys, all ages	30 to 35 cts. per lb.
Eggs, Island	30 to 60 cts. per dozen
Eggs, fresh ranch extra, California	30 to 60 cts. per dozen
Eggs, cold storage, bakery,	5 cts. to 10 cts. less
Eggs, duck	5 to 10 cts. less

(Usually sold so many for a dollar or fraction thereof.)

The demand for capons, and for geese is low; the demand for Hawaiian ducks and duck eggs is quite well supplied by the Chinese duck farms. There is, however, an unsupplied demand for larger ducks, particularly the Muscovies.

POULTRY HOUSES AND YARDS.

Fowls give the greatest profit when run in small flocks of 50 to 100 and given free range so that they pick up a large part of their feed. To keep a large number of fowls and allow them free range means the use of the colony system, in which numerous small houses are scattered at varying distances from each other over the farm. With a smaller area the fowls must be given limited range, according to the area and the number of fowls kept. While furnishing more ideal conditions, the use of colony houses greatly increases the cost of buildings, and the amount of labor required for the care of the flock. Yet, because of the advantages of the system, it has many adherents and is the best system to use in any except mammoth establishments. Plate I shows the arrangement of houses and yards upon the Makiki Heights Poultry Ranch. One of the yards adjoining each house is planted in alfalfa and the other is bare. Water is provided by allowing it to drip from hydrants into vessels, the overflow being allowed to drain directly down into the soil, thus preventing any muddiness in the yards. The roosts are across the rear of the houses with a tight dropping board beneath. Hoppers for charcoal, grit, shells and meat scrap are on a shelf about two feet above the floor along one side. The floor is covered about 10 inches deep with rice hulls

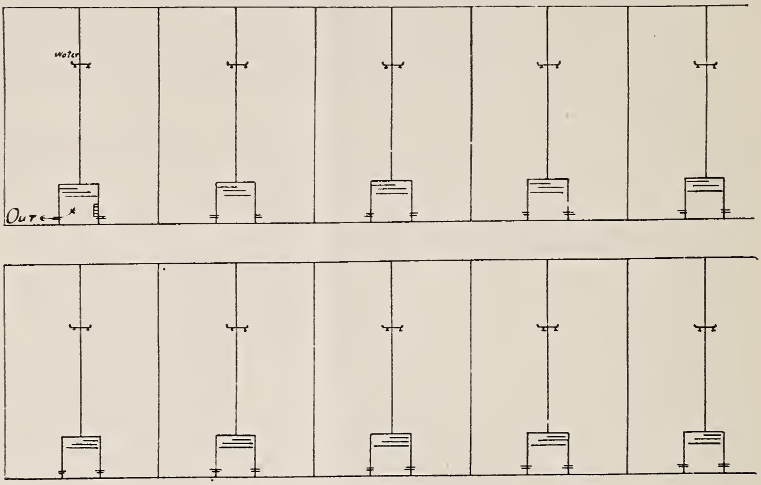

Plate I. Colony Houses and Yards—Limited Area.

from which the chickens must scratch their grain feed, thus securing plenty of exercise. Trapnests are placed on the floor at the rear. The shed is open in front and additional ventilation is provided during the day by opening a 1 x 12-inch board at the rear, which is hinged for this purpose. The opening thus made occurs just above the dropping board, which breaks the draft from the chickens on the floor below. The opening as well as the front are covered with wire. Shiplap being used in the construction of the building, there is no draft through cracks when the ventilator is closed at night. With free range or when scratching floors are provided on the outside, this provision for ventilation would be unnecessary.

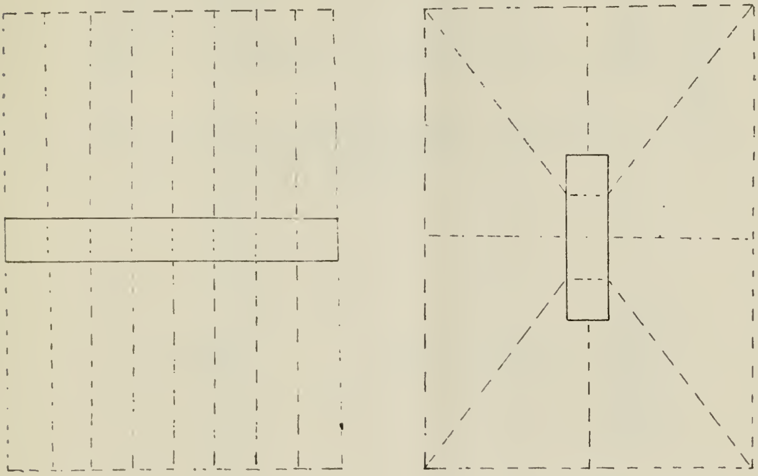
Fig. 1. Small Area

Fig. 2. Larger Area

Plate II. Long Houses and Yards.

Plate II shows arrangements of yards, where a long type of poultry house is used. Long houses must be divided into sections by wire fencing. Less wall space is required in housing large flocks, the labor of caring for the flock is greatly reduced and where the area is restricted this type of house is preferred. Because of its economies, this house is used in large establishments. Where the area is small, narrow yards only, as shown

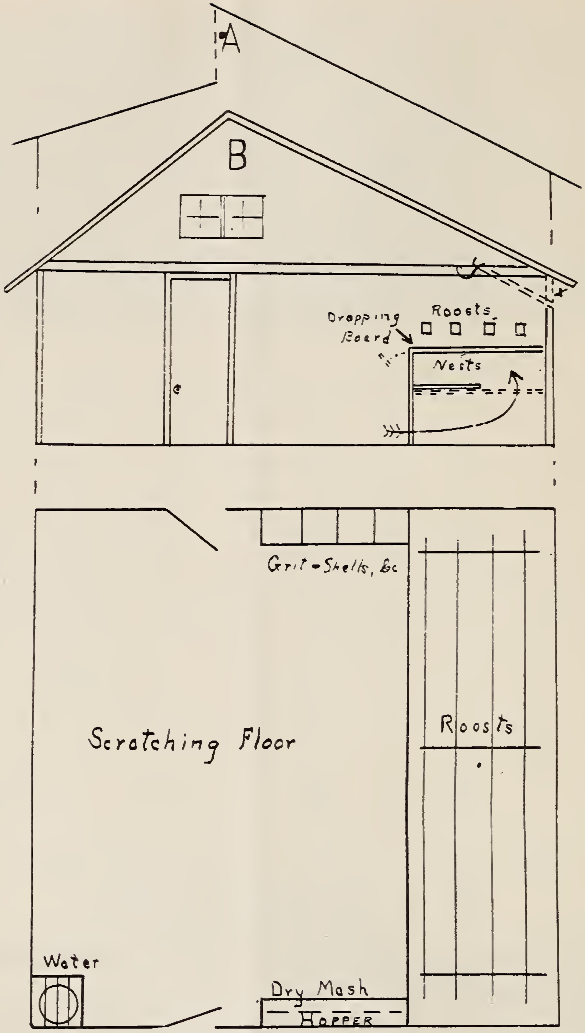

Plate III. Long Type of House.

in fig. 1, are possible and perhaps must be confined to one side of the house; but with more room, larger irregularly shaped yards as in fig. 2 may be made, the great inconvenience in these being that because of their irregular shape and narrowness near

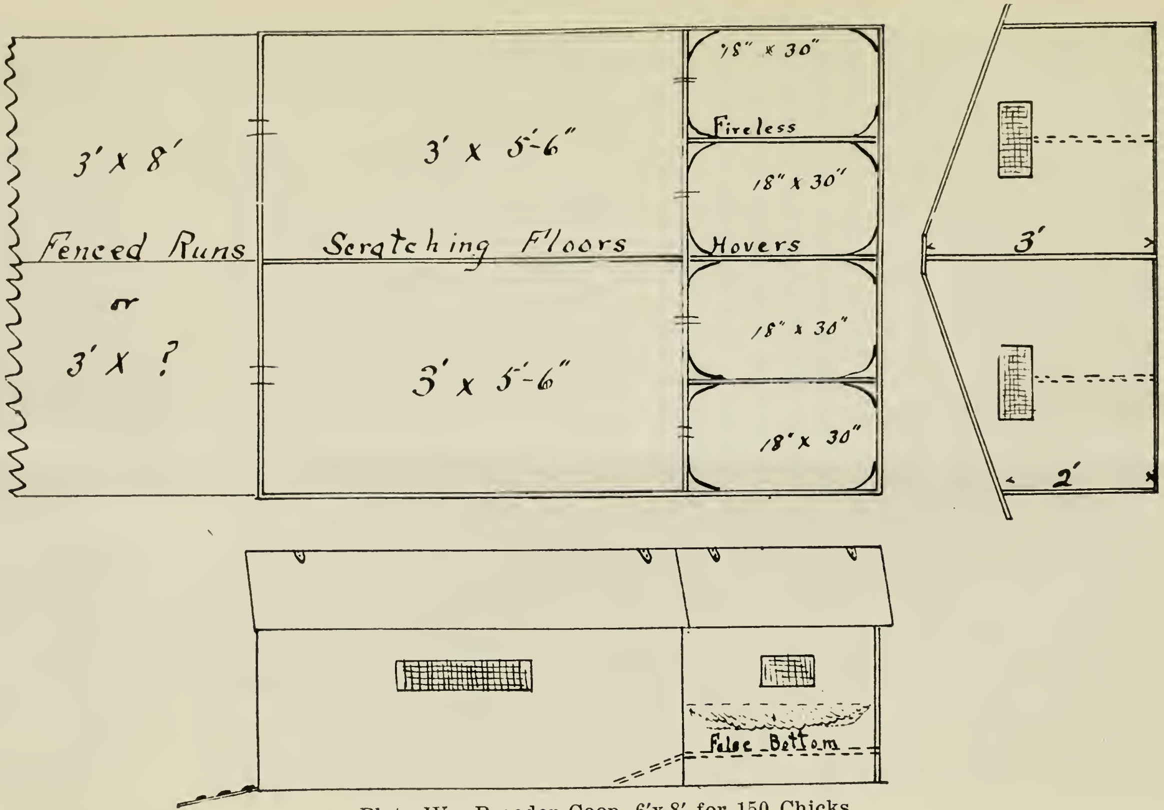

Plate IV. Brooder Coop, 6'x 8' for 150 Chicks.

the building they can not readily be plowed. An example of the long type of house with narrow yards upon but one side is that upon the premises of Mr. F. C. Bailey in Nuuanu valley. This type of house, with interior arrangements as in Plate III is employed also by Mr. J. H. Peterson at Wahiawa. This plate also shows the semi-monitor type of roof at "A" and the gable type at "B". Better ventilation is obtained with the semi-monitor type unless the gable type is fitted with a series of ventilators near the ridge of the roof. Ventilation from the windward side may be provided by leaving the space between the rafters open or by putting in false rafters as shown at "y" and leaving the space "x" open, draft upon the fowls being prevented by ceiling under the rafters or false rafters for a short distance from the wall. This plan of false rafters is in use by Tait Bros., near Diamond Head. The plate also shows location of nests under the dropping board, entrance to them being from the rear, while the eggs are taken out by opening the hinged board in the front.

The nests can be more easily cleaned and the material changed if loose boxes rather than fixed partitions are used. The location of water trough, feed hopper and grit boxes is shown. Such houses are usually divided into sections of twenty feet or less, one section being the equivalent of a colony house of equal size. There is another type of house in which the scratching floor is at the side of, and partitioned from, the roosting room, but the type presents no exceptional advantages and has several disadvantages, especially in higher cost of construction and in inconvenience in caring for the flock. While these plans show a few types of poultry houses, the variations from these are innumerable and each man modifies them to suit his own conditions and ideas of convenience.

BROODERS.

After the first week of their lives little chicks need no heat at the lower elevations, and fireless brooders answer every purpose. In fact, even during the first week and at higher elevations many fowls are raised without any artificial heat being given. Plate IV shows one type of fireless brooder similar to those in use by Mr. J. A. Bortfeld of the Diamond Head poultry ranch. A box 6 x 8 feet or other convenient shape may be used. False bottoms may be used and are more easily removed and cleaned. The roof is hinged in sections which are raised when caring for the chicks or to admit sunlight. Slot doors, and screened openings for ventilation are made. The partitions between the hovers need be but about 12 inches high. The covers of the hovers are light wooden frames to which are tacked pieces of burlap, old quilts or blankets. These sag down in the center and rest upon the backs of the chicks. From thirty to fifty chicks should be placed in such hovers in order to keep themselves warm. When the chicks become larger, the scratching floor may be used as a roosting room, exercise being provided for elsewhere, or the chicks may be given free range.

The Makiki Heights poultry ranch contemplate using electric heaters in their new brooder house for supplying heat to the chicks during the first week. This brooder house is being constructed like the long type of poultry house and divided into sections for the handling of chicks of various ages. It will be rat-proof and supplied also with running water.

Heated brooders are sent out by nearly all manufacturers of poultry supplies and directions for their use accompany them. The heating device in many of these may be removed when no longer needed and the structure used as a fireless brooder. In California, success has been reported in raising chicks without brooders, by keeping them in large rooms warmed by sheet iron stoves burning distillate, the chicks regulating their own heat by varying the distance between them and the stove.

Equipment.

Trapnests, self-feeders, hoppers, feed and water troughs, as well as incubators and brooders, egg packages, etc., are best studied from dealers' catalogues and no description of these need be given here.

BREEDING.

The first step in the breeding of poultry is to secure strong breeding stock. It has been demonstrated that unselected or poorly bred birds of high vitality are more productive and profitable than better bred birds of low vitality. In all works on the subject of breeding livestock, much emphasis is placed upon the subject of selection. In the breeding of poultry, however, more emphasis should be placed on elimination. Constitutional vigor or vitality is so important that the process of elimination must commence when the chicks are but a few days or weeks old. From the very first it will be noticed that some of the birds are more vigorous than the others. The weaker ones should be marked or separated from the better ones and as soon as they are large enough they should be sold as broilers. Any that become sick and afterwards recover should be treated in the same manner. By this gradual elimination process, it will be found that perhaps half of the original number have been eliminated by the time the birds come to the productive age. Then the true process of selection may begin. Conformation is an indicator of vitality and for breeding stock those birds should be selected which have good depth of body, width of back, well-shaped heads and necks, thick short-jointed shanks, with legs set wide apart, as compared with the opposite of these characteristics within the same breed. The wide, deep body gives sufficient space for large digestive and reproductive organs, which are necessary qualifications in profitable fowls. Other indications of vitality in the male are a good fighting spirit, gallantry as indicated by the calling of the hens when he finds a choice bit of feed, and a tendency to use his voice often in crowing. In the female also good use of the voice in singing as she hunts for feed and in cackling after laying, and activity as indicated by short toe nails, early rising and late retiring, are points in their favor which are easily noted.

If no attention be paid to the elimination and selection processes, the poultryman may expect to get such results as a large percentage of infertile eggs, a large loss among the fertile ones because the weak chicks can not get out of the shell, predisposition to disease with great mortality among the chicks before they reach maturity and even among the older birds. From this the prime importance of constitutional vigor will be appreciated.

Breeding Show Birds.

The breeding of birds according to the exact type of the breed, and especially according to color markings, is a business that requires the attention of a specialist or experienced breeder. Just what will be the outcome of certain matings can be told only by experience, and to know just what types to mate in order to secure a certain result is a matter that can only be determined by long years of careful work and accurate record-keeping.

A beginner should choose a breed of solid color of some years' standing, since parti-colored birds, especially of new breeds, are difficult to breed true to type. Also it is much easier to keep black and white birds true to type than buff or red, since there is a tendency to varying shades in the latter colors, and also a likelihood of getting different shades on different parts of the same bird, and there is a still greater tendency towards different color of male and female. In the management of breeds in which the colorings or markings are difficult to maintain, the breeder must pay more attention to the markings of his breeding stock than he does to their vigor or productiveness. Therefore, ordinarily there is likely to be a deterioration in the latter respects against which the average breeder can not contend. This matter requires the attention of experienced men with capital. The amateur with small capital should leave such work alone.

Breeding for Egg Production.

After the elimination of all chicks lacking in vigor and those which for any reason have been stunted, or have recovered from illness; and after the selection of those which have a good conformation and disposition as above described, a further selection must be made. There are certain strains in every breed which have a greater capacity for egg production than have other strains of the same breed. To secure a high average production in a large flock, it becomes necessary to select the breeders from among those which have this high producing power. This can not be done accurately in any other manner than by trapnesting. A trapnest is a nest so arranged that a hen can enter to lay an egg, but can not escape. An attendant must come to release her. While so doing he reads the number on a leg band and immediately records the egg to her credit. This process requires the presence of an attendant continually about the yards and it is out of the question for the average farmer to select in this manner. Instead of trapnesting the entire flock for the entire year and thus ascertaining the complete record of each hen, many breeders modify the method and trapnest only the pullets and only during the fall and winter months, claiming that the ones that begin laying early in the fall and have the largest winter production are the only ones which should be placed in the breeding pens. If one can not take the time to do even this much, he may yet to a certain extent pick out his best birds according to the selective methods, before mentioned:—those that molt late, those that rise early and work late and have short toenails, which facts, considered with a proper conformation, indicate birds of great activity, good appetites, and consequently with a good capacity for production.

Hens, then, that have been tested out as pullets are the only birds that should be placed in the breeding-pens and they should not be forced for heavy winter production since the resulting offspring may be weakened as a result of such forcing. The males should be selected only from high-producing hens since the high producing power is transmitted more strongly through the male than through the hen. A flock may be improved faster by placing such a male with common hens than by placing well-selected hens with a common male. On free range, as many as 25 hens may be allowed to each male, but in yards only 10 or 12 should be allowed. It is a good plan to rest the males a few days each month alternately. The eggs will be fertile in 8 to 10 days after turning in the male and will usually be fertile for 15 to 18 after confining him again. During the spring months, about 90 per cent of the eggs will be fertile and at other times a smaller percentage.

Inbreeding of fowls is possible, even necessary to maintain a certain standard of excellence. The Maine Station found that no detrimental effects have resulted from inbreeding provided the stock had good constitutional vigor.

Violent out-crossing is not recommended. In introducing new blood, allow the male with but a few of the hens until you have determined how well the new blood "nicks" with the old. Then, if satisfactory, the male may be allowed general freedom. Line breeding is preferable to either of the above methods.

Breeds.

The breeds of fowls are divided into four classes or types:—

- Bantams;
- Egg-breeds, to which belong the Leghorns, Minorcas and others;
- General purpose breeds, like the Plymouth Rocks, Orpingtons, Wyandottes, and R. I. Reds;
- Asiatics or heavy breeds, like the Langshans, Cochins and Brahmas.

Many of the general-purpose fowls are as productive as the strictly egg-breeds, but they require much more feed to accomplish this feat. The Single Comb White Leghorn is the favorite upon egg farms because of their heavy production on a small amount of feed. A person starting in the poultry business must select the breed having the weight, color, markings, or comb which best suit his fancy and then try to get stock from a productive strain of this particular breed—the right strain being often more important than the breed.

Incubation.

Whether to use an incubator or to hatch under hens is a question that must be answered by each individual for himself. The consensus of opinion is that chicks hatched under a hen and raised by hens are more vigorous and healthy and make more rapid gains than those hatched in incubators and raised in brooders. However, under artificial methods there is less difficulty in keeping the young birds free of lice and other vermin. The hens of general-purpose breeds are sufficiently inclined to broodiness and enough will be obtained in a small flock for hatching a reasonable number of chicks. In the egg breeds, on the contrary, the hens are disinclined to brood, and the use of an incubator becomes necessary. If with general purpose breeds one wished to hatch but a few dozen, it will be preferable not to use the incubator, but with other breeds, or where several hundreds of chicks are wanted it becomes necessary to use the incubator.

Selecting Eggs.

Select eggs from good breeding stock chosen as above directed. As brown eggs require a few hours longer for incubation it is better to select those of solid color. They should be uniform in size and shape. Odd or mishaped eggs usually hatch crippled chicks. Select also eggs with thick shells, as the thin-shelled ones are liable to break in the turning. Until time for setting, the eggs should be kept in a dry cool place at a temperature between 50 and 65 degrees, if possible. The development of the egg starts at 70 degrees and if they are kept at this temperature some of the eggs may be partly developed when the setting is made. In eggs which become too hot or too cold, or which have been saved for too long a time, the embryo is weakened or destroyed, and no chick or else a weakened chick will be the result. For best results in hatching, no eggs over two weeks old should be used. Turn eggs daily while holding.

Hatching with Hens.

According to some writers, there is better success in hatching with hens if the nests are placed upon the ground or if a square of fresh sod is placed in the bottom of the nest box with a little straw placed above it. Dust the hens with lice powder when setting and at least twice before they come off. Liquid lice-killer is probably best and should be sprinkled freely over nest and nesting material. If mites are prevented and the hen taken off daily for feed and water she comes through the period in much better condition than if neglected. Mites often attack sitting hens in such numbers that they drive them from the nest. From 10 to 16 eggs may be placed under each hen, according to the size of the eggs and hen. It is recommended that two or more hens be set at the same time if possible. Then, if the hatch is poor, the chicks may be brooded by fewer hens than were used in hatching, and the remaining hens may be reset[1] but should be allowed to remain with the second hatch. Keep other hens from laying with those which are sitting, or at least mark the eggs which are intended for hatching. Where a number of hens are kept, it is recommended that there be a separate house for the hens that are sitting. The hen can be moved into this house at night and given a few China eggs; if she returns to the former house she can be moved back again to the sitting house the following night, and will probably remain there after one or two movings. Then she may be given the eggs intended for hatching. Some hens, as those of the Plymouth Rock breed, may be easily moved from one location to another.

Artificial Incubation.

It is advisable to purchase a large incubator since hens may be used for hatching small numbers of chicks. If keeping only egg breeds it is often possible to purchase broody hens of one of the general-purpose breeds if but a few chicks are wanted. Full directions for manipulation accompany each incubator and only a few points need to be mentioned here.

To avoid danger from bacterial diarrhoea, thoroughly disinfect the incubator before using by spraying the interior with cresol or other solution.

Use a medium flame and see that the heat is well regulated to 102 degrees F. before filling. Adjust the thermometer by one known to be right and determine its accuracy. If inaccurate, proper allowance may be made for the error. The thermometer bulb should be about the level of the top of the eggs when placed in the incubator.

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[1] See also under discussion of testing.

Keep the incubator level so that the temperature will be the same about all of the eggs in the trays.

Place the incubator in a cellar or room with a constant temperature (preferably at about 70 degrees) and free of drafts. The hot sun of mid-day, cold winds, or cold night air in the incubator room cause variation of temperature and increase the amount of care necessary to maintain a constant temperature. The variations should be overcome by turning the flame higher or lower and not by changing the regulator.

At the end of the first week the regulator may be changed so that the temperature will be raised to 102½ degrees, and during the last week of incubation, the temperature should be 103 degrees. Some writers recommend that it be slightly higher than this.

Oxygen is necessary for the changes which take place within the shell and proper ventilation is needed to supply this oxygen and to remove the carbon dioxide formed.

After 24 hours the eggs should be turned twice daily until the 18th or 19th day, to prevent the embryo from sticking to the side of the shell. To do this, remove a few eggs from one end or from the center of the tray, and roll the others toward the space made vacant, filling the resulting space with those eggs which were taken out at the beginning.

After several days, cool the eggs each evening when turning them, by leaving the trays outside for 10 to 50 minutes, according to the temperature of the outside air and the period of incubation, more time being required in the later period.

Test for infertile eggs on the 7th and 14th days whether the incubator or hen is used for hatching. By cutting an elliptical hole with a long diameter of one inch in the side of a shoe box, and then placing the box over a lamp so that this hole comes opposite the flame, a very convenient egg-tester is made. "Candling" the eggs is done by holding them to this opening and noting the condition of the contents. In the infertile egg upon the 7th day the air space is larger, the yolk is only distinguished from the white, and shows no development.

In the fertile egg a movable small spot, the developing embryo, is easily seen on the surface of the yolk with the blood vessels radiating from it. These vessels gather food for the developing embryo and carry carbon dioxide to the surface, where it passes out through the shell and is replaced with oxygen. If the germ for any reason be dead, a blood ring will be noticed. This is a dark irregular line forming a circle about two-thirds the diameter of the egg. Or sometimes the egg may be cloudy and not light and clear, as in the infertile egg. Testing upon the 14th day serves to check up the work of the previous test and to eliminate any eggs in which the embryo is dead. Remove all but the good fertile eggs. The infertile eggs found upon the seventh day may be used for cooking purposes, being equally as good as cold storage eggs, or they may be kept and used as feed for the little chicks. If a number of eggs under the hens should prove infertile, gather the good ones under some of the hens and reset the others.

There is a difference of opinion among poultrymen as to the necessity for supplying moisture to the incubator and as to the time when it should be supplied. The object of supplying moisture is to keep the air sufficiently moist so that no moisture will be withdrawn from the egg contents. The best authorities recommend moisture during first and third week. At hatching time it helps to soften the inner shell and enables the chick to break out. Moisture is supplied by placing water in shallow basins with or without sand, on the floor of the incubator.

After the last turning, the incubator should not be opened until the hatching is completed and the chicks are dry. Opening to take out shells which are telescoping over unhatched eggs, may chill the hatched chicks unless the temperature of the room approaches that of the incubator. It is recommended that the glass of the door should be darkened so that the chicks will not pick at each other or at the droppings. Remove to the brooder when the last hatched chicks are about 24 hours old, or if a fireless brooder is to be used the chicks must be hardened to lower temperatures before being removed.

Brooding.

The most critical period in the chick's life is the period from hatching until three weeks of age. Chicks, unlike young mammals, must find their own food. But if the young chicks come of healthy and vigorous stock, and are provided with proper sanitary surroundings and feed of good quality and variety, they will soon begin to improve, and most of them will successfully pass through this critical period of their existence. If several hens have been set at once or at the same time as the incubator, each hen may be given as many as 25 to 40 chicks to mother. She can not, however, protect a large number from cold or rain, and must have dry, warm quarters. Do not feed young chicks until at least 48 hours old. Some poultrymen say that 72 hours should elapse before the chicks receive anything but water. If the chicks are not to be raised with hens, some sort of brooder must be provided. At low elevations in Hawaii, a fireless brooder answers every purpose. At higher elevations, at least during periods when winds are chilly, a heated brooder is more necessary. Whatever the brooder, it should be cleaned and well disinfected before using. If a fireless brooder is used the chicks must be kept for a longer period in the incubator and gradually accustomed or hardened to lower temperatures by opening the ventilator a little wider every few hours and gradually cooling the water or air by which the incubator is heated.

In the management of young chicks the following factors are essential:

Proper protection from storms.

Proper degree of heat and amount of ventilation of the brooders. If the temperature is high enough there will be less tendency to crowd, and less loss from trampling or suffocation. There must be no overheating nor chilling.

There must be plenty of fresh water and the best authorities recommend that some permanganate of potash should be placed in the drinking water from the very first.

They must have the proper food, as explained in a later paragraph.

They must have plenty of exercise, which they will obtain if their feed is placed in cut straw or rice hulls, compelling them to scratch for it.

They must have sanitary surroundings. Their quarters must be kept clean, no diseases allowed a chance to start, and no vermin must be allowed to attack them.

FEEDING THE STOCK

There are several factors to bear in mind in the feeding of poultry. No matter what the particular breed, age of fowl, or purpose of feeding, one should keep in mind that fowls require a certain amount of nitrogenous feed, green feed, mineral feed, fresh water, grit, grain feed. One writer well states that they need "5 G's:—grit, grains, greens, grubs and gumption," the latter being common sense on the part of the feeder, and more important than the other things named.

Grit acts as a substitute for teeth in poultry and is necessary in the gizzard to aid in grinding the feed. Sharp sand or finely crushed rock must be supplied to fowls for this purpose. Oyster shells or other shells are much too soft for use as grit.

Green feed is a great aid to digestion, and fowls that are closely confined eat such feed greedily. Growing alfalfa furnishes green nitrogenous feed. Fowls like it so well that they destroy young growths by continually eating off the leaves. Lettuce, cabbage, kale, rape, onion tops or other garden crops are frequently used as sources of green feed. The leaves of purslane, and sow thistle (pualele) are well liked by poultry, and other weeds and grasses are eaten, but tender leaves are always preferred. Mangles or other roots furnish succulent feed also, and if cut pieces are nailed where the birds can reach them they are sooner or later entirely consumed. In the absence of other feed or where it is necessary to gather green feed for the fowls, most poultrymen furnish such feed in the form of sprouted oats. The oats are soaked for several hours, then spread out in a thin layer in a tray in the sunshine or in a heated room or in a cabinet made for the purpose, and there left until the sprouts are from one to two inches in length, when the entire mass is fed to the birds.

Nitrogenous feed is necessary to balance the ration and to supply material for growth and for egg production. A rather narrow nutritive ration is required for poultry, that usually recommended being one to four. If on free range, the fowls get a good supply of nitrogen in the form of bugs and worms. The leaves of alfalfa, and to a lesser degree, those of peanuts, are eaten and supply much nitrogen. The seed of such legumes as peanuts, pigeon peas, soy beans, cow peas, etc., will supply nitrogen and may be mixed with the other grain feed, either whole or cracked. Beef scrap is the standard commercial article used for supplying nitrogenous feed. Game and pests may be trapped and then cooked and given to the flock. Chickens in Hawaii ought to be very fond of cooked mongoose. Ducks and geese, turkeys or even larger chickens are often a great help in controlling cutworms or army worms in fields and gardens.

The Water Supply.

A running stream of fresh water is the best source of supply. Where water is piped about the premises under pressure, a slight opening of a faucet allowing the water to drop slowly insures a constant supply. In the absence of either of the above, a barrel may be placed on end, slightly elevated, and a faucet placed near the lower end. When this is filled with water and the faucet left slightly open as before, a constant supply of water will be assured. Drinking vessels should be such that the birds can not wade in them, and must be scrubbed and disinfected frequently. Some authorities say that permanganate of potash should always be used in the drinking water, but this is impossible and less necessary where there is running water from a stream or pipe. In case of an epidemic, the fowls should be kept away from any water likely to be polluted, and given only water in which some of the above chemical has been placed. If running water is not supplied, water in drinking vessels should be changed once, preferably twice, a day. Where milk is available, some authorities recommend that milk be given instead of water, either in the form of sour milk or as buttermilk.

Mineral Feeds.

This is especially necessary for the formation of bone in growing chicks, and to laying hens as a source of material for bone and egg shells. Commercial bone meal, fresh ground green or dry bone or even egg shells, may be used to supply mineral feed. Finely crushed coral or other limestone rock and oyster shells may also be used. Powdered green bone supplies a certain amount of nitrogenous feed in addition to the mineral.

Grains.

The principal sources of carbonaceous material in the feed are the cereal grains, wheat, oats, barley, sorghum, milo maize, kaffir corn and buckwheat. Rye and millet are not recommended. The scratch feed usually sold on the market contains a mixture of all, or part, of these grains, together with sunflower seeds, and seeds of the Canada field pea. Grains must form the larger part of any feeding ration. Starchy roots, like arrow root, cassava, taro or potatoes cannot replace them unless cooked, and are of lower feeding value. It is recommended particularly with fowls which are confined in yards, that the scratch feed or grain be scattered in a litter of straw, rice hulls, or dry grass, so that the fowls will have to scratch for it and in this way secure the exercise necessary for their healthful development. Corn should not be fed alone unless the fowls have free range, getting plenty of green feed and grubs. Bran is good poultry feed, furnishing both carbohydrates and nitrogenous material; it is usually fed in moist or dry mashes. Sunflower seeds are low in protein and carbohydrates, but have a much higher fat content than the small grains. Gluten meal is also high in fat and may be used in mash mixtures.

Amount of Feed.

It must be remembered that the productiveness of fowls depends largely upon the amount of food eaten. They must obtain sufficient for their own needs before storing any large amount in a form suitable for human use. The ones then that consume the larger amounts and require the less for their own needs, and can therefore use more for their manufactured product, are the ones that prove the more profitable. Generally the smaller fowls like the Mediterranean breeds lay more eggs upon a given amount of feed and are therefore kept on commercial egg farms. A large total consumption of feed being a requirement for profitable production, the type of bird that has plenty of room for large digestive organs is always to be preferred.

A few fowls well fed will be more profitable than many underfed. Many farmers who have derived a good profit from 30 or 40 hens running free about their farmsteads have been unable to obtain any profit, or have sustained a loss when they increased their flocks to 150 or 200 hens, simply because they failed to supply good feed in proper amounts to the larger flock. The small flock picked up the larger part of their feed, and were able to balance their own ration, and the larger flock was expected to do the same, but the supply was inadequate and therefore the larger flock was less productive proportionately than the smaller.

Cooked Feed and Mashes.

Cooked feeds are excellent for poultry, but unnecessary and uneconomical, unless it be for recently hatched chicks. Mashes are made of ground feeds of various kinds, and are advantageous in the feeding of young chicks and laying hens particularly. Wet mashes should never be given, as they are likely to cause disturbances in the digestive apparatus. Mashes should be given dry or but slightly moistened rather than wet. In the dry form there is never any danger that the fowls will overeat, and larger quantities may be placed before the birds. When moist mashes are fed they should be given only in such amounts as will be eaten at once, after which the hopper in which they were fed must be thoroughly cleaned so that there will be no sour material left for the fowls. The feeding of moist mashes, then, requires more care than the feeding of dry mashes and has been given up by most poultrymen.

Condimental and Forcing Feeds.

Charcoal and salt aid in digestion. Linseed meal is of especial value during the moulting period. Pepper is a stimulating feed and is supposed to increase the appetite and cause the hens to consume more food and lay more eggs; a small amount of pepper in the mashes is recommended. Ginger and other tonics and condition powders also answer this purpose. Meat and powdered green bone are stimulating and are supposed to increase egg production. Ordinarily, if the hens are forced to take plenty of exercise, their appetites will be good and no stimulating food will be necessary.

Feeding Young Chicks.

For the first 48 hours at least, the young chicks live upon the unabsorbed yolk contained in their digestive apparatus. Other food given at this time causes indigestion and, therefore, they should be given only water. Where only a few chicks are to be fed, bread crumbs (of corn or of wheat bread) are a very good feed to use for the first day or so. Some grit should be given the young chicks with the first feed for reasons above mentioned. Where there are a large number of chicks, probably the best feed to give at first is a mixture of bread crumbs, hard-boiled eggs, oatmeal or rolled oats with a small amount of sour milk either in the mash or in a separate vessel in place of water. After a few feeds, a mixture of finely cracked wheat, corn, wheat bran and finely ground oats may be placed in a hopper for the young chicks. Broken grains of rice may be obtained from the rice mills and added to this mixture, being very suitable for feed for young chicks. After a few days the grain may be placed with sand or with cut straw, and the chicks will soon learn to scratch to find the feed. At first this litter may be made of cut alfalfa if it is available, in which case the green feed will be supplied along with the grain. When about one week of age, a dry mash made of bran, middlings, cornmeal or barley meal, beef scrap, powdered bone and a small amount of charcoal may be given the chicks at 10 o'clock in the morning and left before them for a few hours and then at

2 in the afternoon. They should also be given a small amount of grain with another feed towards night. Frequent feeding is necessary while they are very young, but after several days only three feedings a day will be necessary. Free range and exercise in the open air is as important as food, and as soon as accustomed to lower temperatures, the young chicks should be given an opportunity to get these things.

Feeding Laying Hens.

Feed may affect the flavor of the egg, the color of the yolk, the size, and especially the number of eggs. The Oregon Station found that onions and fish affected the flavor. Sugar beets in place of green feed, or a lack of green feed, causes a paleness of the yolk; Dwarf Essex rape colors the yolk green. Some people begin feeding heavily only when the hens begin to lay; if they would only stop to consider that it is the excess of food above maintenance requirements which goes to make eggs, and that hens with more or less fat on them lay more eggs than thin ones, they would understand the necessity of feeding heavily at all times in order to keep the hens up to their full capacity. Most poultrymen recommend that laying hens be given grain feed in the morning in a litter of some kind so that they will be compelled to scratch for it, that at midday they be given a dry mash, and mixed grains again at night.

One mash mixture recommended consists of:

200	lbs.	each of rolled oats, cornmeal and middlings.
150	"	Dry beef scrap.
100	"	Wheat bran.
75	"	Alfalfa meal.
50	"	Gluten meal.
25	"	O. P. oil meal.
25	"	Granulated charcoal.
8	"	Fine salt.

The Diamond Head poultry ranch feeds the following mash mixture:

Bran	24 parts

Soy bean meal	12	“
Middlings	8	“
Meat scrap	8	“
Charcoal	4	“
Pratt’s regulator	2	“
Salt	1	“

This mixture is moistened with cooked potato parings and kitchen slop, then one part of the mixture is mixed with two parts of chopped alfalfa, and 8 quarts fed to 100 birds.

Mrs. Dickson on Makiki Heights feeds:

32	quarts	bran
8	“	cornmeal.
8	“	ground oats.
8	“	middlings.
8	“	meat scrap.
4	“	charcoal.
4	“	bonemeal.
4	“	alfalfa meal.
1	teacup	of table salt.

Feed 1 quart to 12 fowls once daily. The amounts given will feed 90 fowls 10 days. The kind of grain fed varies somewhat although not so much as does the mash mixture. Some use scratch feed both morning and evening and continually; others use scratch feed in the evening, wheat alternating with oats in the morning; and still others use wheat and scratch feed only. The Poultry Department of the College of Hawaii feed about 4 ounces of grain per head per day, at a cost of 17 cents per head per month. J. A. Bortfeld of the Diamond Head poultry ranch gives the cost of feed as 23 to 24 cents per head per month, this including the mash mixture, which the preceding figure does not include.

Honolulu prices of feeds in small amounts in 1914 were:

Scratch feed, $2.40 to $2.50 per 100 lbs.
Chick feed, $4.00 to $5.00 per 100 lbs.
Wheat bran, $1.60 to $1.70 per 100 lbs.
Rice bran, 60c per sack.
Middlings, $1.85 to $1.90 per sack of 90 lbs.

Wheat, white, 2c per lb.
Red wheat, 2c per lb.
Alfalfa meal, first quality, $1.50 per 100 lbs.
Algaroba meal, $1.40 per 80 lbs.
Beef scraps (Darlings), 5c per lb.
Dry ground bones, 2½c per lb.
Green ground bones, 3c per lb.
Oats, 2c per lb.
Rolled or ground oats, 2¼c per lb.
Oilcake meal, 3c per lb.
Cornmeal, 2¼c per lb.
Soy meal (bean), 2½c per lb.
Ground willow charcoal, 5c per lb.
Coarse and fine grit, 2c per lb.
Ground oyster and clam shell, 2c per lb.
Buckwheat seed, 5c per lb.
Millet seed, 5c per lb.
Hemp seed, 5c per lb.
Sunflower seed, 10c per lb.
Kaffir corn, 2½c per lb.
Canada peas for pigeons, 5c per lb.

All authorities are agreed that laying hens should be fed regularly a variety and a large amount of clean, wholesome feed with a narrow nutritive ratio with plenty of water, green food, etc. They also agree that laying hens can not secure too much exercise, and that exercise is fully as important as the feed. Birds of heavier breeds should be given their feed in a deeper litter than is ncessary for lighter breeds since the latter are naturally more active.

HAWAIIAN FEEDS.

Corn may be grown with more or less success at any elevation in Hawaii. At higher elevations spring plantings are usually made; at lower elevations late fall and winter planting will be found to be more successful. Sorghum, kaffir corn, and milo maize are excellent poultry feeds, but these grains can not be saved except in open country away from linnets or rice birds, sparrows, turtle doves, and possibly mynah birds. Protecting individual heads by bagging is possible, but not economical. Small grains do not do well and it will not pay to grow them (at least at the lower elevations). They may be grown as sources of green feed, but other crops such as alfalfa, peanuts, cabbage, and lettuce are much preferred by poultry. Peanuts, pigeon peas, cow peas, soy beans, etc., may be grown easily. For small fowls, these seeds should be cracked and mixed with grains. Ordinarily if the vines with the pods are thrown into the poultry yards, the fowls will thresh and grind the seeds for themselves. Chili peppers are easily grown and a limited amount of pepper may be given the birds in their feed. Papayas are excellent succulent feed. Algaroba meal makes an excellent addition to any dry mash mixture. Cracked rice is always available.

FATTENING.

The fattening of poultry is done upon a large commercial scale in various places upon the mainland. The fowls are placed in crates holding 8 to 12 birds each and fed twice or thrice daily all they will consume of a wet mash mixture, one of the best of which is 2 parts of cornmeal, 2 parts of a low-grade flour and 1 part of shorts, to every pound of which about 2 lbs. of buttermilk or sour milk are added. Mechanical feed mixers and other labor-saving mechanical devices and convenient arrangements in use are such that one man cares for four or five thousand birds. The feeding period varies from 6 to 18 days, averaging about 14, the longer period being economical only in the late summer or early fall and with broilers. The gain in weight during the feeding period varies from 2 per cent to 45 per cent, 20 per cent being a fair average and the actual gain per bird being .5 to .6 lb. From 3 to 5 lbs. of grain are required to make 1 lb. of gain, although as high as 30 lbs. are recorded. For such a feeding period and with ground feed, grit seems to be unnecessary in the feed. Tallow in the ration has usually given good results and gives the fat a good color. Salt is said to keep the birds from picking at one another. Beef scrap or meal may be used in the absence of milk but cannot replace milk in a fattening ration. The object of this forcing is to fatten, not to increase the flesh, and well-grown, vigorous stock must be secured at the start. In Hawaii, difficulty will be encountered in securing the feeds mentioned but substitutes for some of them are available. Cocoanut meal, alfalfa meal, linseed meal, bran, rice, middlings, wheat middlings, algaroba meal and possibly a low grade flour may be obtained, but the cornmeal is difficult to get unless one has a grinder and can grind his own supply. Algaroba meal keeps other stock in fine condition and should be valuable in a fattening ration for poultry. The larger number of fowls on the Honolulu markets have never been properly fed before marketing.

Caponizing.

Many poultrymen find it to their advantage to caponize their surplus stock of young roosters. By so doing, the birds are more easily managed, make greater gains, and, upon most markets, bring a better price. The manufacturers of instruments for the removal of the sex organs send out with the instruments directions for performing the operation, and anyone with a little practice can successfully do the work. Keep in mind that the operation is performed more easily and with better results if done when the cockerels are about eight weeks of age; the size of the wattle is a good index of the size of the testicle and the latter is more easily removed when small. The birds must be starved about 30 hours before operating, so that the intestines will be empty and they can then be pushed out of the way, permitting better light and more room for the operation. The best of light is necessary and should the day be cloudy, feed lightly and wait for another day.

Capons make rapid gains. The flesh is of the best quality and much in demand on some markets. The birds lose their fighting instincts and live peaceably with and ignored by both roosters and hens. The few capons sold upon the Honolulu market heretofore were too small and in too poor condition; the market required better-conditioned and larger birds.

RAISING TURKEYS.

The methods employed in raising turkeys differ in no great degree from those in use in raising chickens. The most attention must be paid to constitutional vigor of the breeding stock, care of the eggs and to the care of the very young poults. While general principles are much the same, there are some important variations that must be noted. The birds must have more range. If given absolute freedom they manage to pick their own living with but little expense to their owners, but if closely confined they require an enormous amount of feed, and do not get sufficient exercise for proper and quick development. During the breeding season, the mature birds must not have absolute freedom since better results are obtained when they are under better control.

Most breeders recommend placing the first eggs under hens, making the turkeys lay more before allowing them to sit. A common hen can cover well only about nine turkey eggs, while a turkey hen may be given as many as fifteen. Other breeders recommend that all turkey eggs be hatched under common hens, but that the young poults be given to turkey hens to raise, for the common hens do not range enough to give the young birds the exercise they need, and they generally overfeed them. Turkey hens may be given 15 to 25 young birds to raise. Pen them closely for a few days until they answer the call of the turkey hen, after which they may be given their liberty in the mornings after the dew is off, making sure that all are housed again safely at night. The main points in the care of the poults are not to let them get wet during the first few weeks, to keep the lice from them, to allow them to get plenty of exercise, green feed, bugs, etc., and never to overfeed them. To keep them free of lice, dust them with insect powders once weekly until six weeks old, after which they will be able to use dust baths to advantage. It is recommended also to grease the mature hens on the breasts and under the wings with bacon grease, kerosene and lard, or other lice ointment.

ARTIFICIAL METHODS.

Artificial incubation is much the same as for the incubation of chicken eggs, 28 days, however, being required. Moisture must be supplied during the entire period. After hatching, the temperature in the incubator must be gradually lowered before removing the poults to brooders. According to the experience obtained by mainland breeders, it will not do to place too many of the young poults in the same brooder, since each tries to get underneath the others in the hover, and in this way there is great loss from smothering. From 25 to 30 in each brooder will be all that can safely be allowed. They do not range far from the brooders nor do they at first understand how to get their feed, but by placing little chicks in with them, they soon commence to eat, following the example set by the chicks.

FEEDING.

After 36 to 48 hours they may be fed cornbread, wheat bread soaked in milk and pressed nearly dry, cottage cheese, hard-boiled eggs, oat flakes, etc., with plenty of tender green feed, a little pepper and some grit. They should be fed four or five times daily for a few days, then the number of feeds may be reduced to three, and if they have plenty of range, two feeds will soon be sufficient or even one, which may be given late in order to induce them to come back to the houses at night. Feed in limited amounts, never giving all that they want. Gradually introduce chick feed, finely cracked grains, and small grains into the ration as the poults develop and when five or six months old corn can be fed. Under artificial brooding or when on limited range a mash of five parts bran, one part beef scrap, may be fed. Mixed grains are better than corn alone for the older birds.

FATTENING.

To fatten, the birds must be confined in small yards to keep them from getting excessive exercise. They must be fed all they can eat, either of corn or of a mixture made of six parts cornmeal, two parts middlings, two parts beef scrap moistened with milk. They should also have green feed.

RAISING DUCKS.

Houses for ducks must be dry and should have a plank floor. A little bedding prevents soiling and breaking of eggs. Confine layers until 9 or 10 A. M., and most of the eggs will be laid in the house. The laying season is during the spring months, but some of the better layers lay eggs regardless of season. Some of the Chinese about Honolulu who keep ducks say that their flocks average between thirty and fifty eggs per season. Others claim as high as ninety. According to poultry journals and farm periodicals, the Indian Runner excels other breeds in laying. The highest egg record in this breed is above 300 eggs within a year. They begin laying when about five months of age. One writer claims that ducks should lay from fifteen to twenty dozen annually but the best record found by the writer was of eight ducks of English Penciled Indian Runners, which laid 1139 eggs from October to June of their first year. The eggs of this breed are said to be less strongly flavored than those of other breeds. Other breeds represented in Hawaii are the Muscovy, Pekin, and the Chinese non-de-script; the Muscovy being the largest, the Pekin next in size, both being larger than the Runners, while the Chinese (or Hawaiian) is probably the smallest of the breeds represented.

To secure fertile eggs, the drakes should number about 20 per cent of the flock. The first eggs laid are usually infertile, after which the per cent of fertility runs higher than in hen eggs, but there is a falling off in this percentage after the middle of the summer. It is said that frightening the ducks affects the number of eggs laid and their fertility. Eggs for hatching should be held below 70 degrees F., turned daily and used as soon as possible, as after a fortnight they become practically worthless for hatching.

INCUBATION.

The eggs require four weeks for incubation. Many prefer to hatch them under common hens. In artificial incubation, better results are obtained by holding the temperature one degree lower than for hen eggs, by giving better ventilation, and more water. The latter is applied warm once or twice a day with a whisk broom or hand sprayer.

The Chinese Method.

In Honolulu there is one, perhaps more, large establishment where duck eggs are incubated by the hundreds. The incubator room is rectangular, perhaps 10 by 40 feet. There is a partition about the height of a sugar barrel, enclosing a four-foot alley in the center, running nearly the length of the room. Behind this partition, along three sides of the room, are placed sixteen barrels, lined with a heavy carpet or packing paper, and the spaces between the barrels, the walls and the alley partition are filled with rice hulls which provide good insulation against loss of heat. About six dozen eggs are placed on sheets of cloth some thirty inches square, and a dozen of these sheets are placed in each barrel, making 864 eggs per barrel. The eggs are placed in the sun until very warm and then placed in the barrels. Charcoal fires in kettles are placed in the central alley only in case of coolness of the weather. In turning the eggs, one barrel is emptied, then the contents of each of the other barrels are moved into the barrel adjacent to it, and the last barrel in the battery is then filled with the eggs taken from the first, if the incubator is being run to its full capacity. This transfer moves every egg except perhaps those in the center of the sheets, and the attendant turns these as he replaces the sheets and eggs in the next barrel. Very few of the eggs are cracked in this manipulation owing to the thickness of the shells. The eggs are candled against 64 c. p. electric light bulbs. Just previous to hatching, the eggs are put in basket-work trays three feet in diameter and eight inches high, and placed on shelving or a sort of loft above the barrels. When hatched, the ducklings are removed daily to various duck farms, being sold at ten cents each. In some cases, hatching is done on a percentage basis.

FEEDING.

Young ducklings should be fed a moist mash. At one Chinese duck farm a moist mash is fed consisting of 4 parts of finely cracked corn, 1 part each of rice middlings, broken rice grains and wheat bran. To narrow a corn or rice ration, beef meal or scrap, alfalfa meal, linseed or peanut meal may be used. At another place very good results with half-grown ducks were obtained by feeding them bran and broken algaroba pods. However, ducks require a more sloppy feed than chickens, and meal or bran feeds should be fed moist. In any case ducks like plenty of water when feeding and will run to and fro between water and feed when it is possible for them to do so. Old ducks on free range do very well on whole corn alone. Ducks are good foragers and consume grass and other green feed, worms, and bugs, and the amount of feed that must be given varies inversely as the opportunity for securing their own. Grit must be supplied in abundance.

One writer recommends as a good feed when forcing for egg production: 4 parts of bran, 3 of shorts, 2 of scalded alfalfa meal, 1 each of beef scrap and oil meal and ½ part of sand—giving one quart to 5 or 6 ducks in the morning and at noon, and at night what corn they will eat, keeping oyster shell and water always before them.

A pond of water is not as necessary for ducks as some imagine, but they must have an abundant supply before them always and deep enough so that they can submerge their eyes and nostrils, as this prevents soreness of the former and clogging of the latter. Greater cleanliness will be obtained if they are compelled to reach through a woven wire for their water.

Ducks are hardy and not much troubled with contagious diseases and are easily confined where wanted, a two-foot fence being sufficient to hold them. They are all good grazers and the mature ones consume much coarse food; they put on weight quickly, feather early, and require but little labor for their care. Stock should be selected from strains which lay white eggs, as these bring higher prices on the markets.

General Remarks.

Cleanliness has already been mentioned—it is repeated here for emphasis. Feed and water vessels should be such that the fowls can not contaminate them.

Exercise is necessary, either upon free range or by scratching in a litter. Leghorns and other egg breeds require less compulsion in this matter. A frequent change of the litter is necessary in order to prevent it from becoming filthy.

Sloppy feeds should be avoided for chickens—moist mashes are permissible but dry mashes are preferable except for fattening. Charcoal aids in digestion.

When possible a change in yards is strongly recommended. Plow the land and grow some crop in one while the poultry have the run of the other. Provide shade for the fowls by growing fruit trees such as bananas, papayas, mangoes, or avocadoes.

Keep good hens until three years old, some say four. Use them for breeding rather than pullets. The record of a pullet is not yet made, her eggs are smaller, and her color may change in moulting.

Too many fowls in the same flock or in the same house will not do as well as a smaller number. Provide a nest for each 6 or 7 hens. Avoid overcrowding, also, of growing chicks in brooders, as this is a cause of much loss.

To break up broody hens, suspend them from a tree in a slat coop, thus allowing a free circulation of air around and beneath them. Feed them heavily.

Confine the roosters after the breeding season is over so as to produce infertile eggs for the market. Likewise, separate the cockerels from the pullets as soon as the sex can be determined. Feed heavily those not wanted for breeding purposes, whether or not they have been caponized.

To identify the chicks from certain eggs, mark the eggs and then two days before hatching sew each in a small bag made of mosquito netting large enough so that the chick can get out of the shell. Toe-mark when taking out of the bag.

The age of all fowls should be kept by using toe-marks or leg-bands with numbers. To keep trapnest records with a number of fowls, the leg-bands are a necessity.

In producing eggs for market great care must be exercised to keep the eggs clean (washing damages them); to keep the eggs or the egg containers out of the sun; to ship every few days as eggs can not be held long in a warm climate; to grade the eggs according to size and color and to exclude all checked or cracked eggs ;and to use good crates in which the eggs are amply protected against breakage.

SANITATION.

To keep the flock free of disease and insects requires continual systematic care. Given strong, vigorous birds, the following precautions should be taken to insure their health, remembering that prevention of most of the ailments of poultry is possible, and that the cure of sick birds is not always possible and rarely profitable, since recovered birds seldom regain the vigor which they formerly possessed.

1. Select the best possible location and construct suitable buildings. The important thing about a location is that it be well drained.

2. Maintain cleanliness. This is by far the most important thing in the care of the flock, and includes cleanliness of houses, birds, feed, water, air, range, incubators, brooders, nests, in fact of everything in any way connected with the flock.

The interior of the houses should be whitewashed at least once annually. Whitewash is a cheap sanitary application for interiors, makes the building light, and prevents the nesting of insects in the cracks or crevices of the walls. The interior fixtures should be movable in order that they may be taken down for thorough cleansing, and for the same reason they should be of planed No. 1 material. Lice killer must be applied to all fixtures at frequent intervals. Most authorities recommend thorough disinfection of houses and fixtures twice annually after having cleaned them well with broom and scrubbing brushes.

Pure air is important but in the mild climate of Hawaii buildings are usually so open as to eliminate the question of ventilation. Perhaps only in brooders will this question need careful attention, since in these there may be an overcrowding as the chicks become larger, and loss is liable to occur if proper ventilation is not provided. Musty or moldy feed should never be given, drinking water must be fresh and clean and placed if possible so that it cannot be contaminated; enough permanganate of potash should be added to deeply color the water. This acts as a germicide. The droppings and all filthy litter should be cleaned out regularly and often. The brooders and incubators must be scrubbed and disinfected each time before using. If the yards are so arranged that they may be used as runs and for growing crops alternately, they may easily be kept clean, otherwise lime or some other disinfectant must be used.

3. Quarantine. A strict quarantine is an important factor in prevention of disease. Newly purchased birds and those returning from shows should be placed in quarantine until known to be free of disease or vermin, and ought to be dipped in weak solutions of creolin or zenoleum before being allowed to mix with other fowls . Dogs, pigeons, and even visitors, should not be allowed to carry infection from one establishment to another.

4. Diagnose and Execute. The successful poultryman trains himself to recognize the first symptoms of sickness in his birds and immediately quarantines or isolates the sick individuals and tries to prevent spread of disease in his flock. If the trouble is a new one to him, he studies the bird, observes all the further symptoms that develop, inquires into the condition of feed, water and so on, studies some good text book on poultry diseases and tries to diagnose or determine the nature of the illness. Then, if not a serious trouble, remedies may be administered, or, if serious, the bird is destroyed at once and buried deeply or preferably burned. If one has a large flock, it is usually better to dispose of sick birds, and disinfect the premises, than it is to try and treat the case and in the meantime to allow the entire flock to be exposed to the disease. Some poultrymen make it a rule never to allow a bird to die on the

place. They use an axe some time before this event is likely to occur.

DISEASES.

Catarrh and Colds.

Colds are common among poultry in Hawaii, probably on account of the poor protection often given against the trade winds and cold rains. The symptoms are the same as in similar troubles in the human family:—secretion of mucus which clogs the nostrils and causes difficult breathing, inflammation of the eyes, loss of appetite, etc.

First, improve environment so that no further exposure occurs. Massage the head about the nostrils so as to loosen the discharge and then hold the head for several seconds in a solution of permanganate of potash or of creolin. The solutions may be injected into the nostrils with a dropper or pipette, or small spring-bottom oil can. The following mixure is also recommended:

40 drops of refined carbolic acid.
1 teaspoonful menthol crystals.
6 teaspoonsful kerosene.
2 teaspoonsful eucalyptus oil.
6 teaspoonsful olive oil.

A two-grain capsule of quinine daily for a few days is beneficial.

Croup or Bronchitis.

This is a deeply seated cold. The patient must be kept warm and dry. Feed mash and milk and for severe cases give daily for two days, two teaspoonsful of the following mixture:

1 teaspoonful castor or olive oil.
5 drops of syrup or wine of ipecac.

Another treatment for mild cases is tincture of aconite, 1 drop every two hours in mash for one day. Two grains of black antimony in milk mash twice daily is also recommended.

Distemper.

is a form of cold in which the disease is in the eyes more than in the nose; the eyes are puffed and on the second day froth is noticed in the corners. The eyes may be treated with 2 per cent solution of boracic acid and bromide of potassium placed in the drinking water; usually the same remedial measures as for ordinary colds will be effective.

PNEUMONIA.

Pneumonia affects the lower portion of the lungs rather than the bronchi and air passages above. The disease requires a long time to run. Treatment of any except very valuable birds is not recommended. One writer recommends keeping the bird in a warm room and giving, every six hours, 1 grain of phenacetin and 1 grain sulpho-carbolate of zinc, mixed with bread crumbs into a pill; feed raw eggs and milk. Tincture of aconite in the drinking water or 1 drop every 2 hours in the egg and milk will help to control the hard breathing. If successful in saving the bird, build up its strength with tonics.

ROUP.

Roup includes contagious catarrh, diphtheria, diphtheritic roup and canker. Some authors claim sorehead to be a form of this disease. In some of its forms, roup is quite prevalent in Hawaii. The symptoms vary. The first thing to be noticed is a putrid discharge from the nostrils and a general indisposition or sleepiness of the fowl. Loss of appetite occurs, although in some chronic cases this is not noticeable until later. Finally, there will be more or less severe diarrhea resulting in the death of the bird. Young fowls and well-bred ones seem to be more liable to the disease. Some few birds seem to be entirely immune. Infection takes place usually in birds suffering from colds or in weaker individuals. The stronger, more healthy ones contract the disease only in bad weather. A few chronic cases serve to carry over roup from one period of bad weather to the next and hence the disease is very difficult to eradicate from a flock. Other symptoms often noticed are the formation of cheeselike masses in the upper nostrils. The nasal passages may be entirely stopped, or the attack may be confined to the eye. The formation of cheesy matter in the eye may force the eye from the socket. More often, however, the inflammation caused by the attack destroys the eye. In nearly every flock of chickens, there may be found individuals with but one eye; the writer has noticed one small flock in which about one-fifth of the birds had suffered such loss.

In the diphtheritic form of roup, there is a formation of false membranes in the throat and floor of the mouth. As these enlarge, breathing becomes more difficult until finally the bird dies of suffocation. It requires some time for the disease to run its course; mild cases often, apparently or truly, recover, but usually there is a steady advance of the disease. The specific organism causing the disease is not definitely known.

Prevention is more easily accomplished than cure. Outbreaks of roup follow exposure and catarrh. Prevent exposure; keep the birds well nourished, strong and healthy; kill off the chronic carriers; quarantine as before suggested, include in the quarantine even the tools which may have been used in infected yards. If there is an outbreak, take steps to prevent its spread such as isolating the sick birds, disinfecting yards and buildings; placing permanganate of potash in the water and burning or burying deeply all birds that die of the disease.

One writer says, "I have cured many bad cases of roup but quit treating them years ago, because I found that as long as I cured roup, I had more roup to cure." He deems it better to destroy all sources of infection.

When false membranes are noticed they should be removed and the surfaces treated with silver nitrate or a strong solution of hydrochloric acid; eyes when affected may be treated with 2 per cent boracic acid in a decoction of chamomile flowers; nostrils may be cleaned with ½ per cent solution of corrosive sublimate, or 2½ per cent solution of creolin and glycerine, or creolin alone. Massaging the head about the nostrils and eyes to loosen the discharge and then holding the head for a few seconds in a solution of permanganate of potash is of benefit in milder cases. This treatment is given twice daily and is recommended because more easily given than the application of creolin and other drugs mentioned.

INDIGESTION.

When birds are inclined to sit around upon the roosts, appear dull and indisposed, have no appetite or eat excessive amounts of grit, they usually have some form of indigestion. It may be accompanied by either constipation or diarrhea. Observe all recommendations as to good environment and good, pure feed and water. Place charcoal in their mash, see that they get exercise in some way, and give a good tonic. (See list below.)

CROP BOUND.

The symptoms of this trouble are loss of appetite, ruffled feathers, pale comb, and a full, hard crop. It is due to a paralysis of the muscles or to a clogging of the outlet of the crop. Loosen the contents by giving equal parts of castor and sweet oils in small doses, meanwhile kneading the crop until contents are well loosened. Hold the bird with head down and try to work part of the contents out through the mouth.

CONSTIPATION.

For constipation, it is necessary to change the feed and particularly to see that the fowls obtain more green food. If lower passages are obstructed, inject oil and soften the material. Purgatives must be given in amounts according to the exigencies of the case.

DIARRHOEA.

This may be caused by uncleanliness of food or water, too much green or soft feed, too much pepper or condition powders. The cause should be determined and removed or remedied. Scalded milk or charcoal in the mash may check the diarrhoea. Irritating or poisonous materials in the digestive tract, from eating moldy feed, may be removed by giving 1-3 teaspoonful of Epsom salts, dissolved and mixed in mash, or 1 tablespoonful of olive oil, or 1 teaspoonful of castor oil; use low-grade flour or middlings in place of some of the bran in the mash and add charcoal.

DYSENTERY.

Dysentery is an aggravated form of diarrhoea in which the mucus of the intestines becomes inflamed and portions of it flake off and are voided with the excrement. Physic the fowls and thoroughly clean up the quarters. Salmon recommends one of the following treatments:

3 grains subnitrate of bismuth.
1 grain powdered cinnamon or cloves.
3 grains powdered willow charcoal.

Give two times daily with food or made into a pill with flour and water; or

3 grains subnitrate of bismuth.
1 grain bicarbonate of soda.
2 grains powdered cinchona bark.

Mix and give three times daily in a paste made with rice flour.

CHOLERA.

This affects all classes of poultry. It is a bacterial disease and is spread in various ways such as by infected droppings or soil carried on the feet of men or animals, by eggs from infected birds, by newly hatched chicks, or the germ may be carried about by the wind. The disease often progresses so rapidly that birds are found dead without any symptoms having been noticed. The usual symptoms are loss of appetite, dark comb, unsteady gait, drooping head and tail and general appearance of unthriftiness, fever, thirst, intense diarrhoea, and rapid emaciation.

A close observer will note at first a "yellow discoloration of the urates, or that part of the excrement which is secreted by the kidneys." An emerald green color in the other portion of the droppings will also be noted. There is no cure for affected fowls. All birds known to be sick with cholera should be killed and burned at once. Isolate suspected cases, putting but a few birds in each pen. If possible, it is well to divide up the main flock into numerous pens of a few each, so as better to control the scourge. Put a few drops of creolin or 1-10 grain of corrosive sublimate in each quart of drinking water. Do not bleed the birds while killing or at least clean up all the blood spilled and destroy it with the carcass. Burn all litter and use no more until the epidemic is checked; spray all parts of buildings with strong solution of creolin or 1 per cent of sulphuric acid in water. Repeat the thorough disinfection if one does not check the progress of the disease. Epidemics of true cholera are rare and where proper methods are employed there is no likelihood of trouble.

Coccidiosis.

This is another disease caused by minute organisms and is readily spread by contamination of food, water, or soil. As a result of the disease there is an inflammation of the small intestines near the gizzard and of the cæca; the inflammation may extend to the liver and lungs. Adults resist the attacks much better than do chicks. The general symptoms of loss of weight, weakness, sleepiness, etc., are noted. Many recover quickly; many die of the attack; and sometimes there are fatal results without any symptoms having been shown. Geese are said to have another form of this disease in which the kidneys are attacked.

Put 12 grains of copperas or 15 of catechu in each gallon of drinking water; give also ¾ to 1 grain of calomel or 2 to 3 teaspoonsful of castor oil with 5 to 10 drops of turpentine. Disinfect with 10 per cent compound cresol solution.

Aspergillosis.

This trouble is caused by a common fungus the spores of which develop rapidly under good conditions of warmth and moisture which they find in the body. The spores are introduced into the body from moldy hay or straw in which the fowls scratch. The filaments penetrate the tissues of lungs, air sacs, bronchi, trachea, mouth, and may also occur in the alimentary tract. Death results from suffocation but in intermediate stages are noted such symptoms as difficult breathing, rattling or choking sounds, diarrhoea, sleepiness and general weakness. Apply flowers of sulphur or tincture of iodine to patches in mouth or throat; cause the birds to inhale vapor of tar-water or turpentine. The former is obtained by stirring 2 tablespoonsful of wood tar in 1 quart of warm water. In a closed room, pour tar-water, a small amount at a time, upon a hot brick or stone until the air is laden with the vapor.

White Diarrhoea of Chicks.

This is common among chicks artificially incubated and brooded. The attack occurs when the chicks are from 2 to 7 days old, and fatalities occur from then on, mostly in the second and third weeks but often extending into the fourth and fifth weeks of the life of the chicks. Unless attacked before three weeks of age, the brood will probably escape. The predisposing causes are weakness of the stomach at this age, weakened breeding stock, improper incubation, brooding or feeding. The disease, however, is infectious, being caused by parasitic organisms.

The chicks appear stupid, remain under the hover or hen, keep apart from the others, the feathers are rough, the wings droop, there is loss of weight, the chicks eat little or nothing, being apparently unable to pick up their food. There is a white discharge from the vent, although this is sometimes creamy or mixed with brown; the discharged matter is sticky, and clings to the down; the chick presents the appearance of having a big belly and a short back and they usually peep constantly as if in pain, while the cry becomes more shrill when voiding excrement. The large amount of white matter secreted by the kidneys is due to fever and rapid breaking down of the tissues.

Since the disease may be handed down from hen to chick through the egg, it is important to select eggs only from hens known to be free of the disease. In an infected flock, the noninfected individuals may be determined only by trapnesting and keeping accurate records of the hatching of each hen's eggs and noting whether or not the offspring develop the disease. After selecting eggs from vigorous stock free of this disease, see that the incubators and brooders are thoroughly disinfected before using. Try to keep the chicks in small lots after hatching, to prevent the spread of the disease if it should occur. Feed food and water uncontaminated by droppings. Some fine absorptive material like alfalfa meal should be used as litter, as it easily covers and seals up the droppings. Feed charcoal in the mash and green food every day and use permanganate in the water.

Tuberculosis.

The liver, spleen, and intestines and less frequently other organs of the body develop tubercles. The disease is chonic, contagious and usually fatal. The symptoms are not usually observed when the internal organs are attacked, until the disease reaches an advanced stage. First there is loss of weight, wasting of muscles, paleness of the comb, and later, dullness, sleepiness and diarrhoea. Swellings of the joints, lameness, and formation of hard external tumors are symtoms.

No treatment is effective; the whole flock must be sacrificed and thorough disinfection made. Emaciated birds must be burned but others in better condition may be consumed, providing that the offal is carefully destroyed and hands well disinfected after drawing.

Sorehead or Chicken Pox.

This is perhaps the most troublesome of all chicken diseases in Hawaii. It is especially destructive in that it attacks chicks from three to ten weeks of age, often rendering them blind and preventing feeding. It is more prevalent in late spring or early summer months. The disease attacks first only the head, comb, wattles, or mouth parts and at this stage may be usually cured, but when more deeply seated in nasal passages or trachea, or even in the intestines, the loss is likely to be much greater. The disease is confused in Hawaii with eye worm trouble but the probable connection between the two is that the eye is irritated by the worm, and the bird, to relieve the irritation, scratches its head near the eye, causing an abrasion of the skin in which the germs of sorehead easily lodge and develop.

Some authorities claim that this is a form of roup, but most of them are agreed that it is a separate disease. It is said to be contagious, and also to be carried by ants, gnats, mosquitoes, mites, lice, and possibly by cockroaches. Many have had success in avoiding the trouble by keeping the young chicks at night under mosquito wire, while others have said that the wire was of no avail. The consensus of opinion is, however, that the wire is effective.

The symptoms of scabby formations about the head and the consequent loss of energy and final death of the chicks are well known. Treatment consists of application of weak solutions of creolin or lysol to the sores. Synol Oil Soap, saturated solution of boric acid, tincture of iodine, silver nitrate, axle grease, are other remedies recommended for application to sores after removing the scabs. The scabs may be softened by use of carbolated ointment, glycerine, or oil and removed by washing with soapy water.

Rheumatism.

This is caused by exposure to dampness or cold or drafts and occurs usually in poorly constructed and ill-ventilated houses, but may sometimes be due to improper care and feeding. The fowls lack energy, become inactive, walk lame, and have stiff and often swollen joints. Keep in a warm, dry and properly ventilated room and give plenty of green feed; rub joints with tincture of arnica.

Leg Weakness.

In old birds this is called rheumatism but the name is more usually applied to a trouble affecting chicks from 1 to 6 months of age. The trouble is more or less common in Hawaii. It is said to be more common among cockerels than pullets and to be found more frequently in birds of the heavier breeds. When rapidly growing birds are on full feed their weight increases faster than their strength and the result is a weak-kneed, wobbling bird. It is also caused by improper heat conditions in brooders. In the first stages of the attack, the birds are otherwise strong and well, but gradually they get weaker and weaker, the combs lose color, they feather out poorly and finally perish.

As they are subject to rough treatment when left with well birds, they must be placed in separate pens. Give bran, oatmeal or sprouted oats rather than corn or cornmeal; give skim milk in place of water if possible, and plenty of green food. Apply tincture of arnica as for rheumatism, and give ½ teaspoonful of tincture of nux vomica to each quart of drinking water.

Inflammation of the Oviduct.

There is great suffering and straining with a body temperature of 105 degrees to 107 degrees, which later falls below normal, the bird becomes cold and finally dies. The trouble is caused by too much stimulating feed, frequent egg-laying or too large eggs. Give no more stimulating feed; provide plenty of green feed; give Epsom salts, and 1-10 grain tablet of aconite root and feed sparingly for several days.

LICE, MITES AND VERMIN.

Lice.

There are many species of lice which attack fowls. The general effect of lice on fowls is to reduce the flesh, vitality, and productiveness. The effects are more noticeable in the case of young birds. Lice spread from mother to chicks and from one individual to another by way of the roosts. They flourish in dark, dirty, damp houses and upon unhealthy fowls. Ailing birds, sitting hens, and young chicks require special attention to keep them free of lice, while mature healthy birds with plenty of range and dry soil in which to dust themselves keep fairly clean of lice. The parasites may be easily found under the wings, or about the head and neck, or near the vent. The males are usually smaller and less numerous than the females. The eggs will be found cemented to the barbs of the feathers.

Preventive measures include painting the building with whitewash containing 5 per cent carbolic acid or creolin, or 1 per cent corrosive sublimate, saturation of the roosts and nests with kerosene or other lice-killer, the providing of dust baths.

Remedial measures are more troublesome. Burn litter and nesting material, scrub roosts and boxes and saturate with lice killer; treat each individual with powder or liquid lice killer before allowing them to re-enter the building and repeat the treatment in a few days as eggs or nits may in the meantime have hatched.

Mites.

The common mite is red when gorged with blood but when empty is gray in color. They visit the fowls only to feed and at night, although some may be found on the birds during the day and plenty of them on sitting hens at any time. They stay on the under sides of the perches, in filth, in cracks and crevices, in nesting material, etc. They reproduce rapidly, the young feeding at first on filth or on decayed wood. The mature forms prefer but do not need animal feed. They attack mammals as well as fowls.

Preventive and remedial measures are in part the same as for lice. If smooth, sound lumber is used for the fixtures and if lice killer is freely used, mites will never be troublesome. In case of attack, burn litter and nesting material, scrub and disinfect with creolin or some form of kerosene or with lice killer. A 5 per cent solution of cresol is one of the best mixtures recommended for general use.

The Scaly Leg Mite.

The disease known as scaly leg is caused by a mite which works under the scales of the leg, the bites causing great irritation. A blister appears, which after a time breaks and the serum dries into a scale. The piling up of this dried material from numerous bites gives the characteristic appearance of scaly leg. Various treatments are recommended. Soak the scabby portion in warm, soapy water, removing the scabs as much as possible. Then scrub thoroughly with kerosene, pure or in an emulsion, using a nail brush. An ointment made of 1 part oil of caraway and 5 parts white vaseline, or one made of equal parts of vaseline and zinc ointment, is also recommended. Dipping the legs in kerosene or in lime-sulphur dip, or in kerosene 1 part to raw linseed oil 2 parts, is effective. The writer has treated several by taking a baking powder tin two-thirds filled with water to which was added a half-inch of kerosene and dipping the legs, being careful not to allow the kerosene to get upon the feathers. Whatever the treatment used, it must be repeated once or twice at intervals of a few days.

The Depluming Mite.

This mite causes a loss of feathers, all except the large wing and tail feathers. Birds pull their own or one another's feathers when the irritation becomes great. Some claim no evil results from the attack of this mite, but it is likely to check or reduce egg-laying.

Rub liquids or ointments into the skin at base of the feathers, repeating every four or five days. The following are recommended: Oil of caraway and vaseline, 1 part to 5; carbolic acid and vaseline, 1 part to 50; Helmerichs' ointment; flowers of sulphur 1 dram, carbonate of potash 20 grains, and lard or vaseline ½ oz.; creolin 1 part to 10 of water; Balsam of Peru dry or in alcohol 1 part to 3; or, creolin 1 dram, glycerine 2 oz., alcohol ½ oz. and water ½ oz.

Other mites, including the harvest mite, live upon the body or feathers but they succumb to the lice powders or other remedies previously given. Chicken fleas often attack fowls at night, as do the red mites; the same remedies are effective. A generous use of lime prevents their further propagation. Greasing heads of young poults with carbolated vaseline has proven effective.

WORMS.

Accurate diagnosis of worms can be made only when the worms have been found, no distinguishing symptoms being known. The finding of worms in the droppings or in the intestines, etc., of slaughtered birds, is the only sure method of determining their presence.

Tape worms, round worms, and flukes are found in the intestinal tract. Paleness of comb, indigestion, and diarrhoea are symptoms.

Tapeworms have an intermediate host and do not complete their life history in fowls; the latter take them up in snails, slugs, flies, or earthworms.

TREATMENTS.

A decoction of pumpkin seeds is said to be effective; powdered areca nut 30 to 45 grains mixed with butter into a pill; powdered pomegranate root bark, 1 teaspoonful for 50 birds, given in the feed; male fern, 30 gr. to 1 dram; extract of same, 15 to 30 drops; oil of turpentine, 1 to 3 teaspoonsful, introduced into the crop through a flexible, oiled catheter. The birds should be fasted, the medicine given in the morning and this followed a few hours later with 2 or 3 teaspoonsful of castor oil or 40 grains of Epsom salts per bird. Areca nut and male fern are said to affect turkeys and geese unfavorably. They should be given only in small doses.

ROUND WORMS.

These may be found in the cæca of almost any fowl, as they are much more common than the tape worms; and are also less troublesome to the fowls. When numerous, however, they cause great irritation and often clog the intestinal tract. Thymol, 1 grain given in a pill with bread and butter; santonine, 2 grains dissolved in water and given in feed; 1 fresh egg and 1 teaspoonful of turpentine—1 teaspoonful of mixture twice daily for a few days; 1-16 ounce of powdered areca nut daily for four days followed by a dessertspoonful of sweet oil two hours after each dose. These are some of the better treatments recommended.

FLUKES.

Little is known of these beyond the fact that they are found in fowls and that they do not seem to be as troublesome as when found in some of the other domestic animals.

THE GAPEWORM.

These are minute parasitic worms found in the air passages. The symptoms are frequent gaping, sneezing, a whistling cough with discharge of mucus and worms, dumpishness, weakness and drooping wings. If the trouble is gapes, the worms will be found in the trachea attached in pairs to the mucus membrane —the two sexes joined so as to resemble a double-headed worm. The worm is a nematode; the female about ½ inch long, the male about 1-5 inch. They cause irritation and secretion of mucus; the mucus and worms may be coughed up or in some cases they suffocate the bird or cause them to die from loss of blood. The eggs escape by the rupturing of the bodies of the females. The parasites may be taken up in the egg or embryonic or mature form, in dirty feed or water or in earthworms. The egg may develop at least partly, in the digestive tract, but it is not known how the nematode reaches the trachea.

Copperas in the drinking water, also tincture of asafetida, 1 teaspoonful to 1 quart of water, are said to be preventive, the latter being also curative. Salicylate of soda, 3 drams to a quart of water, is said to destroy the eggs or embryos.

Three to ten drops of a 5 per cent solution of salicylate of soda injected into the trachea through a soft rubber tube may expel the worms. Extraction of the worms will be the safest method in extreme cases. Strip a large feather almost to the tip, dip this in turpentine or creolin solution, insert it into the trachea and twist it about and withdraw it, bringing out some of the worms, repeating until all are taken out and destroyed. Wire extractors are sold for this purpose, or horse hairs may be used.

Isolate individual cases to prevent spread; burn heads and necks of all affected birds killed; clean up trough and water dishes; do not run poultry on infested soil for three years if possible; if not possible use lime freely on the soil or spray with one of the following:—Sulphuric acid 2 per cent; 2 oz. of copperas to each pail of water used; or ½ oz. of permanganate of potash to each barrel of water.

Eye Worm of Chickens.

This is another nematode worm and one which is quite common in Hawaii. The life history has been incompletely worked out. The eggs and embryonic forms have been found in the droppings, in the soil beneath the droppings and in the dust baths where the chickens had dusted themselves about the base of mango and other trees, but the mature forms have been found only in the eye. They are found in the tear cavity, where often large numbers occur.

The worms infest chicks as young at least as ten days old, in which case they set up such an irritation that the chicks can not see to feed and consequently starve. They are found beneath the nictitating membrane, but especially in young chicks, may often be seen upon the surface of the eyeball. If numerous, a slight pressure with the thumb-nail and an upward-backward rub, repeated a few times, will cause them to show themselves upon the eyeball; or by introducing a small cotton swab beneath the nictitating membrane and passing it up and out, the worms may be forced out of the cavity. A convenient swab is easily made by twisting a bit of cotton on a toothpick. In examining the eye, a 5 per cent solution of cocaine is almost imperative because of the sensitiveness of the eye, which causes the fowl to struggle. If the cocaine be rubbed over the ball and lids, an examination is much more easily made.

Treatment must be individual. After cocaining the eye, drop a few drops of 5 per cent or 6 per cent solution of creolin or zenoleum into the tear cavity, holding back the membrane with a cotton swab. Inexperienced operatives will be able to treat, with the aid of an assistant, both eyes of 15 to 20 birds per hour. A slight soreness follows this treatment but recovery is rapid. If thoroughly done, one application is usually sufficient. If the worms are numerous, it will probably be advisable to remove most of them from the eye after treating. The free use of lime probably will hold eyeworms in check by destroying the immature forms. Remove droppings to fields not frequented by the chickens.

DISINFECTANTS, WHITEWASHES, TONICS.

Disinfectants.

Before using disinfectants, sweep, wash, and scrub walls, floors and fixtures.

Fumigation with formaldehyde gas, for nearly air-tight structures only. Use 23 ounces of permanganate of potash and 3 pints of formaldehyde (40 per cent) to each 1000 cubic feet of space; the temperature of the air should be about 80 degrees F. for the best results. Dampen the air by sprinkling hot water on the floor; use a large earthen dish so that the liquid will not boil over upon the floor; place the permanganate in first. Leave the building closed for 5 or 6 hours, then ventilate thoroughly.

Cresol disinfectant, compound solution of cresol. Dissolve 22 ounces of commercial lye or Babbitt's potash in about ½ pint of water and allow it to stand for three hours . Place 3 1-5 quarts of raw linseed oil in a 5-gallon stone crock and add the cold lye solution to this slowly, keeping the mixture well stirred. This addition should require not less than five minutes; continue stirring until the mixture has the texture of a smooth liquid soap, (it requires about ½ hour). Before this has time to harden, add while stirring, 8½ quarts of commercial cresol. Use a 3 per cent mixture and apply with a spray pump. Use 6 per cent on incubators or brooders liable to be infected with germs of white diarrhoea.

Carbolic acid solution, 5 per cent, may be used but the acid is expensive and somewhat difficult to dissolve.

Lime-sulphur. Unslaked lime 1 lb., sulphur 3 lbs., and water 12 gallons. Boil for two hours.

Whitewashes.

Whitewashes containing organic matter such as milk, glue, flour, or cactus are not to be used in damp interior places.

Government Whitewash. Slake ½ bushel of lime with boiling water; strain and add 1 peck of salt, dissolved in warm water. Put 3 lbs. of ground rice in boiling water and boil to a thin paste. Dissolve ½ lb. of powdered Spanish whiting and 1 lb. of clear glue in warm water. Mix all these well together and let stand for several days. Keep over a portable furnace and apply hot with brushes.

Cactus-lime mixture. If cactus leaves are sliced and macerated in water for 24 hours, a creamy liquid will result; add slaked lime. The resulting mixture is said to be a very enduring whitewash.

Dissolve 2 lbs. of glue in 7 pints of water and add 6 ounces of bichromate of potassium dissolved in a pint of hot water. Stir mixture well and add sufficient whiting to bring it up to the usual consistency and apply at once. Use anilin dye or powdered coloring for any desired color.

Ordinary Whitewash. Slake 10 lbs. of quick lime in 2 gallons of water, covering the pail to retain the heat; the right amount of water is important; allow to stand about 1 hour.

Carbolic Whitewash. The addition of carbolic acid to whitewash for disinfection purposes is possible but the resulting color is not as white as one could wish. If the walls are well whitewashed, the lime will sufficiently disinfect.

Lice Killers and Powders.

Crude carbolic acid 1 part to two or three parts of kerosene.

Kerosene Emulsion. Shave ½ lb. hard soap into 1 gallon of soft water and boil until dissolved. Remove to safe distance from the fire and add 2 gallons of kerosene, stirring until emulsified. Use 1 part of emulsion with 9 or 10 parts of water as a spray.

Cornell Powder. Gasoline 3 parts with crude carbolic acid 1 part (90 per cent acid or cresol may be used in place of acid).

Add enough Plaster of Paris to take up all the moisture. Dust the fowls well with the resulting powder.

Persian insect powder.

Pyrethrum and sulphur—equal parts.

Grease young chicks with lard. Sulphur and lard may be used on older birds. Blue ointment has also been recommended.

Mercury 50 parts; lard, 25; suet, 23; oleate of mercury, 2; render the suet and mix with the lard, then add the mercury and oleate before it hardens and stir well; thin with glycerine if necessary. Place a little of this ointment in the fluff below the vent.

Tonics.

Pulverized gentian, 1 lb.
Pulverized ginger, ¼ lb.
Pulverized iron sulphate, ½ lb.
Saltpetre, ¼ lb.

Give 2 to 3 tablespoonsful in 10 quarts of dry mash.

Powdered fennel, anise, coriander, cinchona, 30 grains of each.
Powdered gentian and ginger, 1 dram of each.
Powdered sulphate of iron, 15 grains.

Give in feed 2 to 14 grains for each fowl.

Nux vomica, quinine and calomel in small amounts are also tonic in their effects.